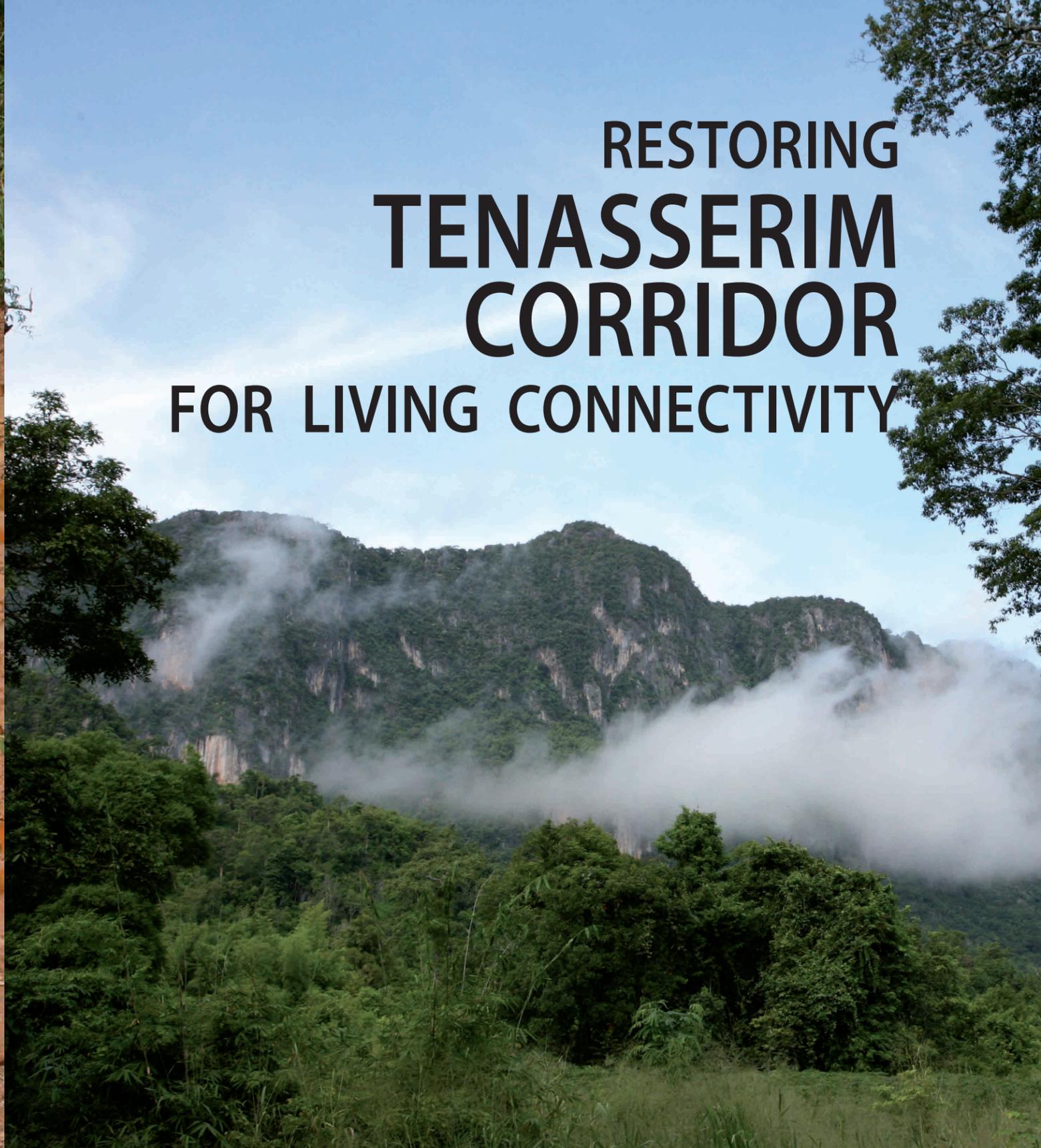




# RESTORING TENASSERIM CORRIDOR FOR LIVING CONNECTIVITY





### Principal roles of corridors

The intended functions of corridor are to facilitate wildlife movement, dispersal patterns, patch recolonization, to reduce inbreeding, and to increase gene flow and stability of metapopulations and metacommunities.

This connectivity may also be critical for adapting to long-term changes such as climate change, sustaining natural processes of water cycles and pollination, and develop solutions that protect nature while supporting human well-being.



Photo by Kwanchai Waitanyakarn, WCS Thailand

# RESTORING TENASSERIM CORRIDOR FOR LIVING CONNECTIVITY

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# WHY TENASSERIM CORRIDOR?

## Tenasserim corridor's natural significance

- It links two important core areas of the Western Forest Complex (WEFCOM) and Kaeng Krachan Forest Complex (KKFC).
- It has a potential for transboundary natural resource conservation and management between Thailand and Myanmar.
- Tenasserim landscape is classified as tiger conservation landscape Class I (Supporting more than 100 tigers and evidence of breeding) and Global priority (Highest possibility of persistence of tiger populations over the long term) (Sanderson et al. 2005)
- Tenasserim core areas (WEFCOM and KKFC) have been classified Important Bird Areas (IBAs) that contains many globally threatened bird species (Bird Conservation Society of Thailand 2004).

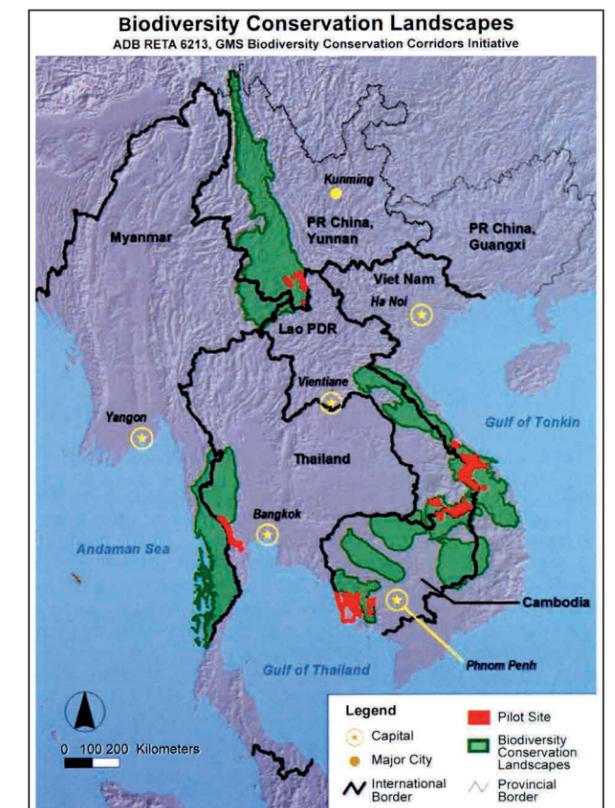
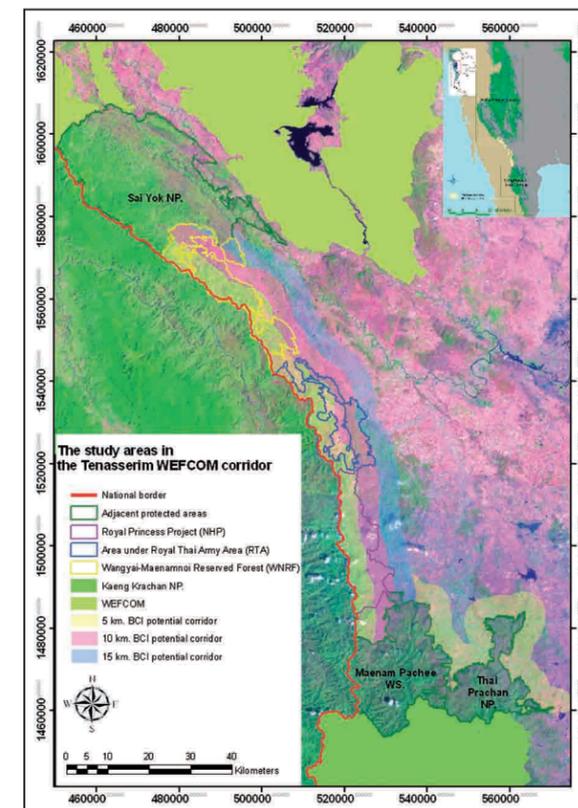
## Challenges in Tenasserim landscape

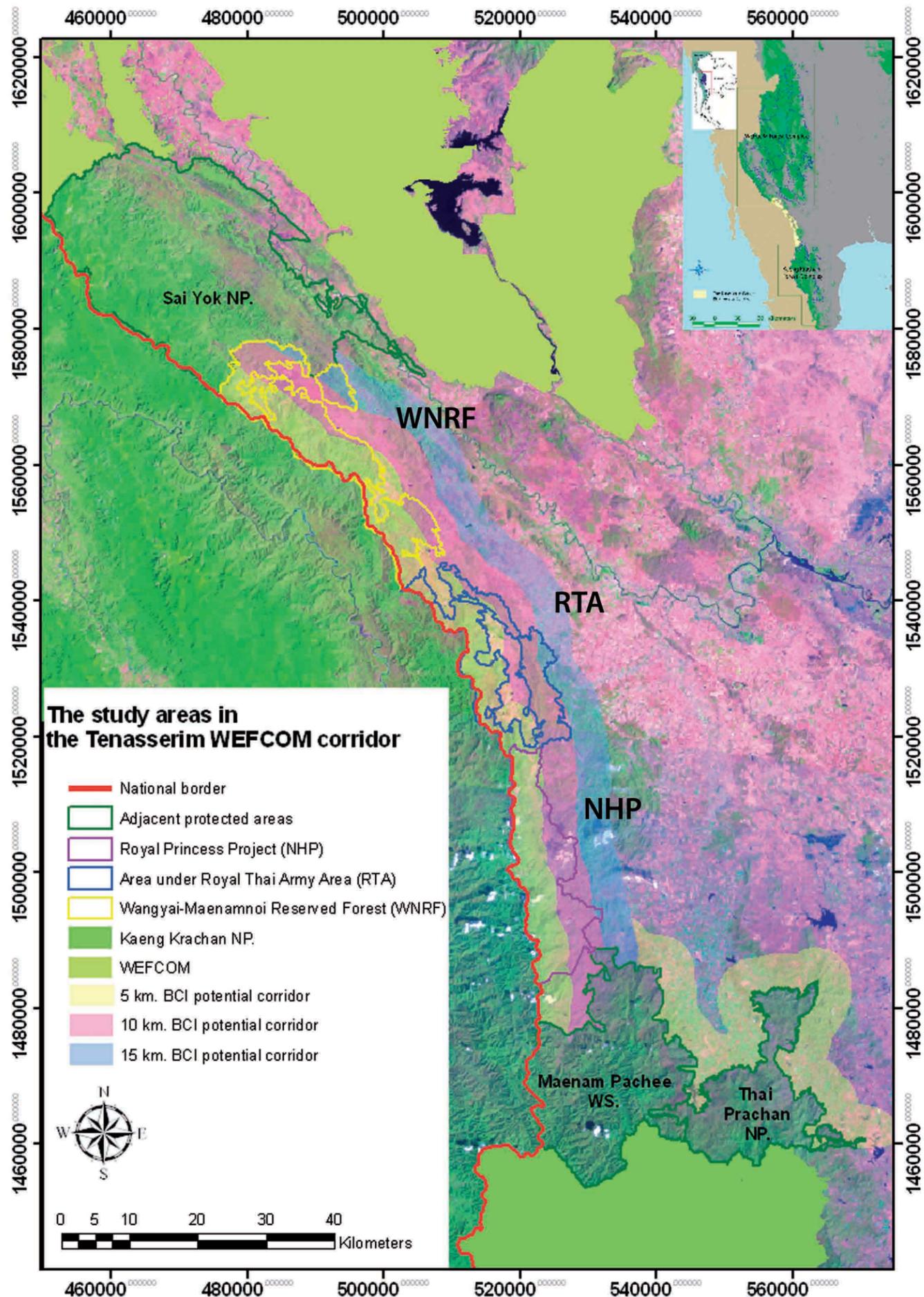
Key challenges identified by Wikramanayake 2002 and BirdLife International 2003 are:

- Conversion to agriculture and plantations, especially in the corridor area.
- Illegal loggings in and around protected areas.
- Wildlife poaching especially in the Tenasserim's core areas.
- Exploitation of forest products in corridor and core areas.
- Myanmar to join the conservation and management based on transboundary initiative.
- Restoring integrity of buffer zones of protected areas.

This study mainly focuses on 6 main areas.

- 1) Sai Yok National Park (SINP) (Part of WEFCOM core area),
- 2) Maenam Pachee Wildlife Sanctuary (MPWS) (Part of KKFC core area),
- 3) Chalerm Prakit Thai Prachan National park (PCNP) (part of KKFC core area),
- 4) Wang Yai-Maenam Noi National Reserved Forest,
- 5) Area under supervision of Royal Thai Army (RTA), and
- 6) The Natural History Park initiated by the Princess Sirindhorn (NHP).





# WCS ASSIGNMENTS

WCS Thailand Program, the project implementing agency (IA) of the Tenasserim Biodiversity Conservation Corridor Initiative (BCI) under supervision of the GMS-EOC Thailand, and the Department of National Parks, Wildlife and Plant Conservation was given assignments to assess **Wildlife and Its Habitat in the Corridor Zone under the BCI Pilot Site in the Tenasserim WEFCOM Thailand** in order to determine wildlife and habitat status along the corridor zone and adjacent core areas using landscape species approach and to identify corridors or stepping stones for landscape species for future conservation and rehabilitation program. The work was conducted between 2006-2008 in the corridor area.



## Work objectives

1. Conduct rapid assessment on status of target landscape species and their habitats in the corridor and adjacent core areas between the Western Forest Complex (WEFCOM) and Kaeng Krachan Forest Complex (KKFC).
2. Identify critical corridor areas or stepping stones to facilitate movement of key landscape species.
3. Set up long-term monitoring program for landscape species and threats in the corridor zone.
4. Train local people and protected area staff to conduct long-term monitoring system.
5. Promote conservation value of wildlife and forest along the corridor zone.

## Outputs

1. Distribution maps and database of landscape species in BCI WEFCOM corridors
2. Maps and database on status as corridor and stepping stones for landscape species

## Outcomes

1. Baseline data with clear understanding of status of BCI WEFCOM corridor to support movement and sustainability of landscape species
2. The more effective planning on restoration and conservation of habitat from project findings.

## Impact

Direction of management and conservation BCI corridor will be guided by the outputs.

# LANDSCAPE SPECIES PLAYING KEY ROLE



## Pre-survey gives hope for connectivity in Tenasserim corridor

The pre-survey in 2006 showed Tenasserim corridor supports some 20 species of large- and medium- sized mammals and 4 hornbill species. Of 24 species found, 16 species are listed in IUCN Red data list (2008).

To think of maintaining and restoring connectivity in this landscape wildlife is the key component to take into account of guiding the work.

Therefore, WCS landscape species concept is adopted for selecting suite of species as a representative for maintaining and restoring the corridors.

## Why Landscape Species approach?

Landscape species are

- Species that require large areas to maintain viable populations,
- Species that need ecologically diverse habitats and, as a result, that are fragile to land-use and resource-harvesting practices of people,
- Species that receive threats from human activities,
- Species that play significant roles on the structure and function of natural ecosystems,
- Species that provide a proxy for socio-economic significances.

## What are the Landscape Species for Tenasserim corridor?

Based on the landscape species approach, a suite of landscape species for Tenasserim corridor was selected from a pool of 15 candidate species by a consensus of scientists and managers who are familiar with the Tenasserim corridor.

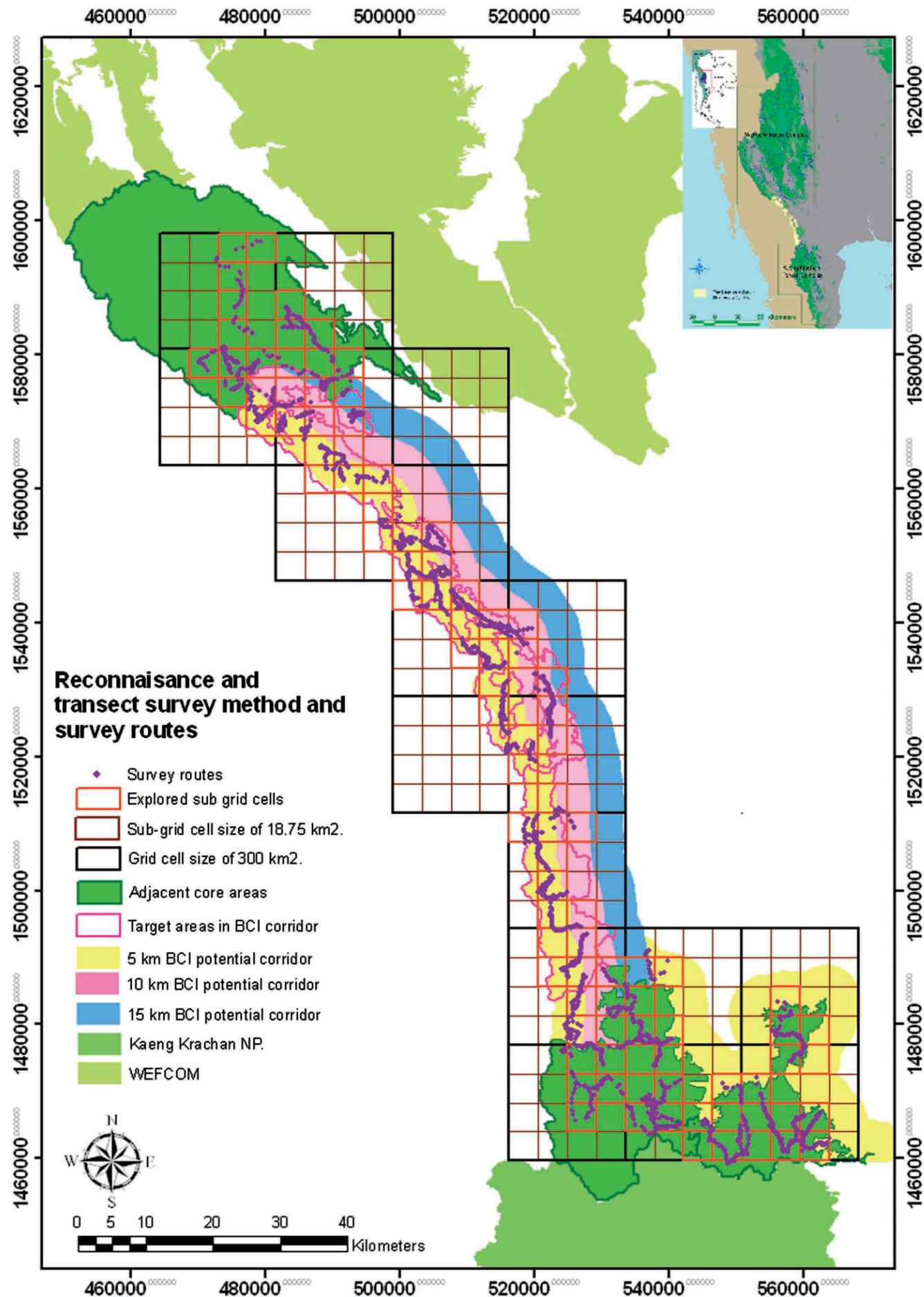
Landscape species for Tenasserim corridor are:

- Asian elephant
- Gaur
- Serow
- Great hornbill.
- Common muntjac
- Indochinese tiger and leopards
- Sambar

Common Name	Habitat Types	Management Zone	Threats
Elephant	6	1	1
Gaur	1	1	1
Serow	0	2	2
Great Hornbill	0	1	1
Common Muntjac	1	1	1
Tiger	0	0	1
Sambar	0	0	1
<b>TOTAL</b>	<b>8</b>	<b>6</b>	<b>8</b>

*Maintaining and restoring all landscape species = Protecting 8 major habitat types + Reducing 8 key threats in Tenasserim corridor*

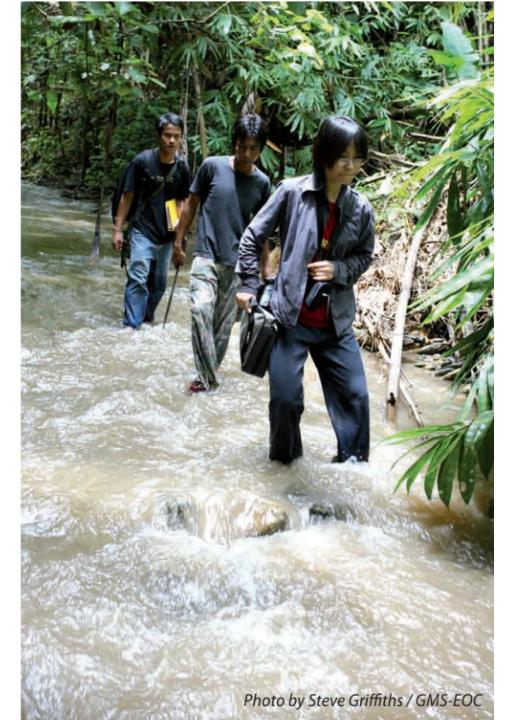
# FIELD SURVEY DESIGN



Grid based system with the cell size of 18 sq.km, the approximate cell size based on home range size of most ungulate species, were overlaid on top of the whole Tenasserim corridor and adjacent core areas. The idea was to distribute the survey effort to cover every grid cell as much as possible.

Trial surveys were conducted for 13 months in both wet (May to November 2007) and dry seasons (December to April 2007-8).

Tracks, signs, physical sightings of wildlife were collected using standardized data forms and GPS. Distance of walking in each grid varies due to trail existence and accessibility. The total distance walked to survey targeted species was 711 sq. km.



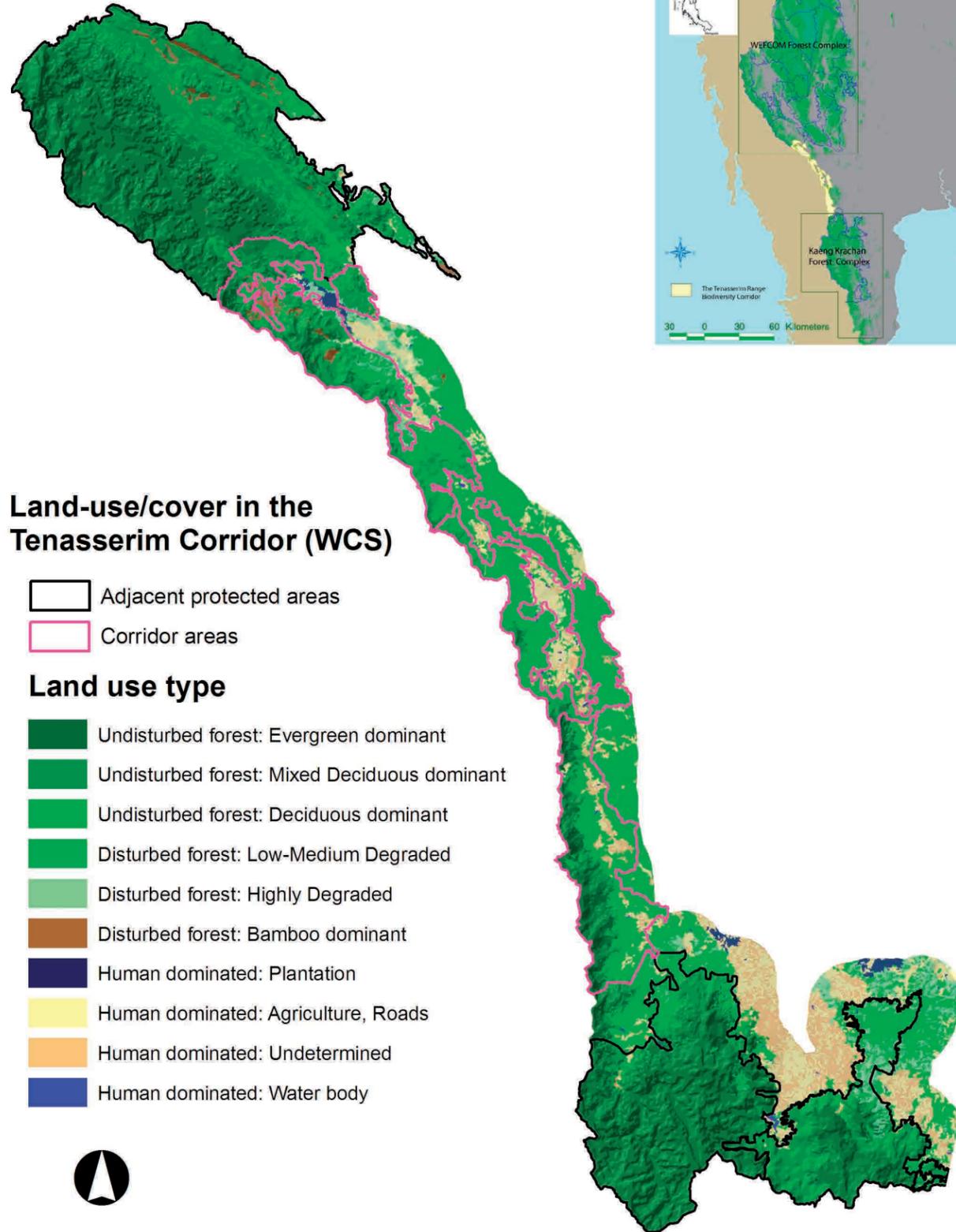
# FOREST AND LANDUSE IN THE LANDSCAPE

## Tenasserim corridor's most updated landcover

Forest type and land use is an important factor to determine wildlife distribution and status in the Tenasserim corridor. WCS Thailand was given an assignment from the Department of National Park, Wildlife, and Plant Conservation to improve the map of forest types and land use in the corridor area. There are 10 land cover types in The Tenasserim corridor and adjacent core areas as shown in the table (WCS Thailand 2009).



Forest Types & Landuse	Area (ha)	% of Landscape
<b>Undisturbed forests</b>		
Undisturbed dry evergreen forest	103,247	29.23
Undisturbed mixed deciduous forest	70,402	19.93
Undisturbed dry dipterocarp forest	24,314	6.88
<b>Sub total</b>	<b>197,963</b>	<b>56.04</b>
<b>Disturbed forests</b>		
Highly disturbed forest	12,578	3.56
Medium disturbed forest	89,963	25.47
Bamboo	2,653	0.75
<b>Sub total</b>	<b>105,194</b>	<b>29.78</b>
<b>Human dominated area</b>		
Agriculture area	29,796	8.44
Others	17,753	5.03
Water body	569	0.16
Teak plantation	768	0.22
Other plantations	1,164	0.33
<b>Sub total</b>	<b>50,042</b>	<b>14.18</b>
<b>Grand total</b>	<b>353,207</b>	<b>100.00</b>

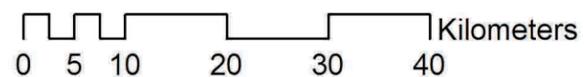


## Land-use/cover in the Tenasserim Corridor (WCS)

- Adjacent protected areas
- Corridor areas

### Land use type

- Undisturbed forest: Evergreen dominant
- Undisturbed forest: Mixed Deciduous dominant
- Undisturbed forest: Deciduous dominant
- Disturbed forest: Low-Medium Degraded
- Disturbed forest: Highly Degraded
- Disturbed forest: Bamboo dominant
- Human dominated: Plantation
- Human dominated: Agriculture, Roads
- Human dominated: Undetermined
- Human dominated: Water body

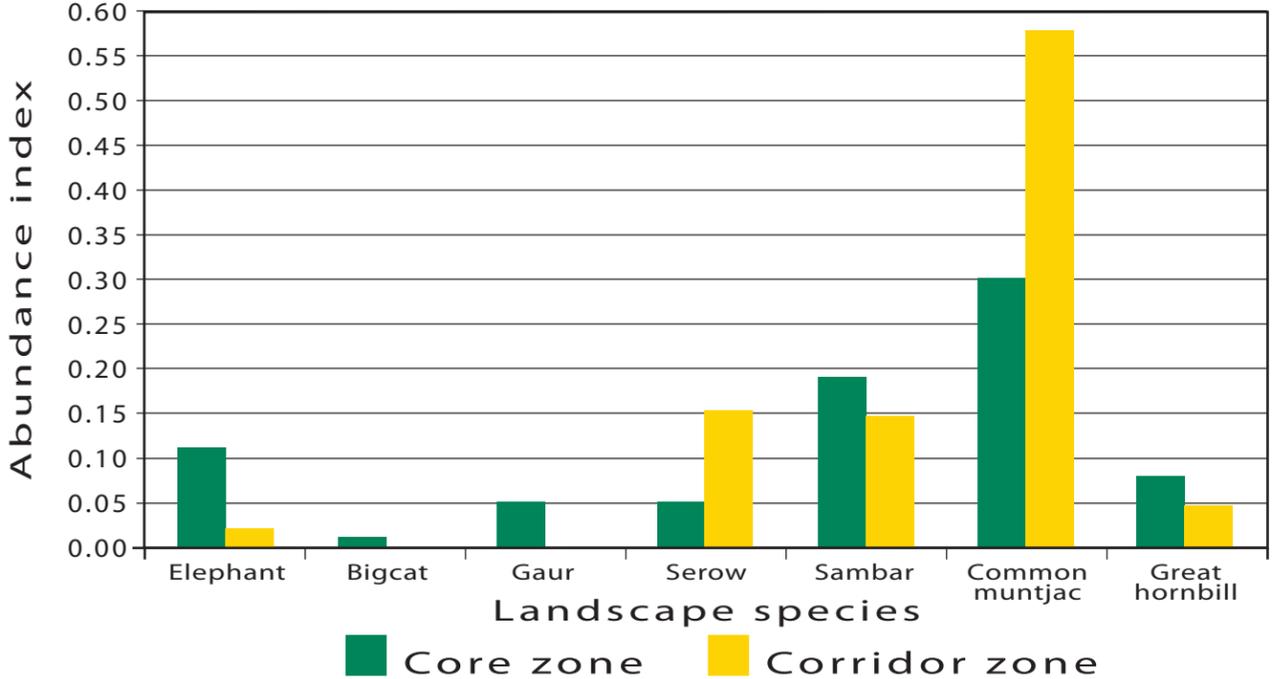


# ABUNDANCE OF WILDLIFE IN TENASSERIM CORRIDOR



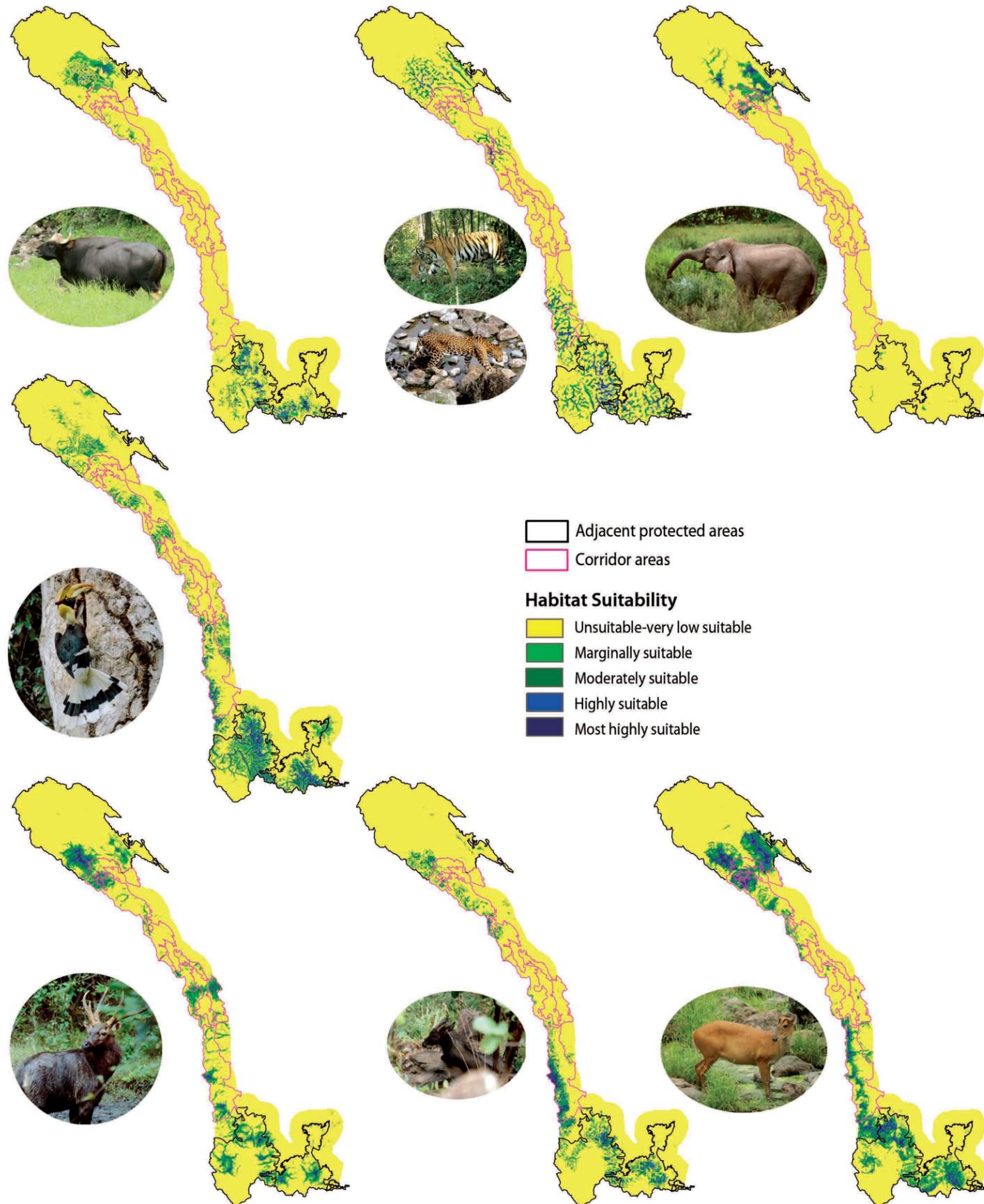
Twenty species of large and medium sized mammals and 4 hornbills were found in the Tenasserim corridor and adjacent core area during the study period.

Elephants were found only in the northern part of Tenasserim corridor and inside Sai Yok National park, Gaurs in core areas of both north and south of the corridor, and big cats only in the southern core areas. Immediate hope is about the finding that the sambar, serow, and great hornbills still use degraded corridor zone. The most common landscape species in corridor zone is muntjac.



The graph shows Abundance index (numbers of encounter of animal tracks & signs per km.) Common muntjac and sambar were distributed through the corridor and core areas. Abundances of all landscape species in protected areas were higher than those in the corridor (See models on pages 16-17)

Photo by Steve Griffiths / GMS-EOC



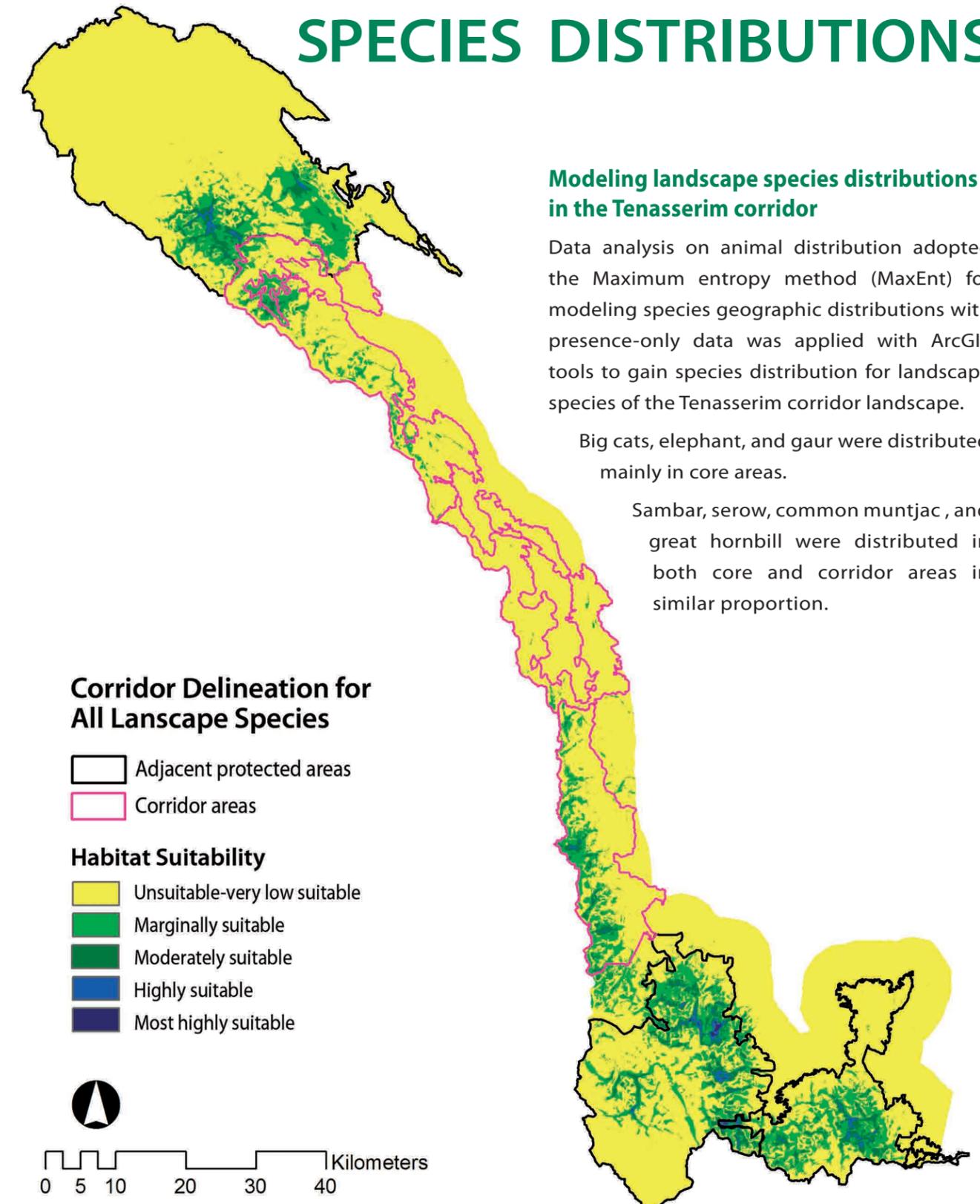
# MODELING LANDSCAPE SPECIES DISTRIBUTIONS

## Modeling landscape species distributions in the Tenasserim corridor

Data analysis on animal distribution adopted the Maximum entropy method (MaxEnt) for modeling species geographic distributions with presence-only data was applied with ArcGIS tools to gain species distribution for landscape species of the Tenasserim corridor landscape.

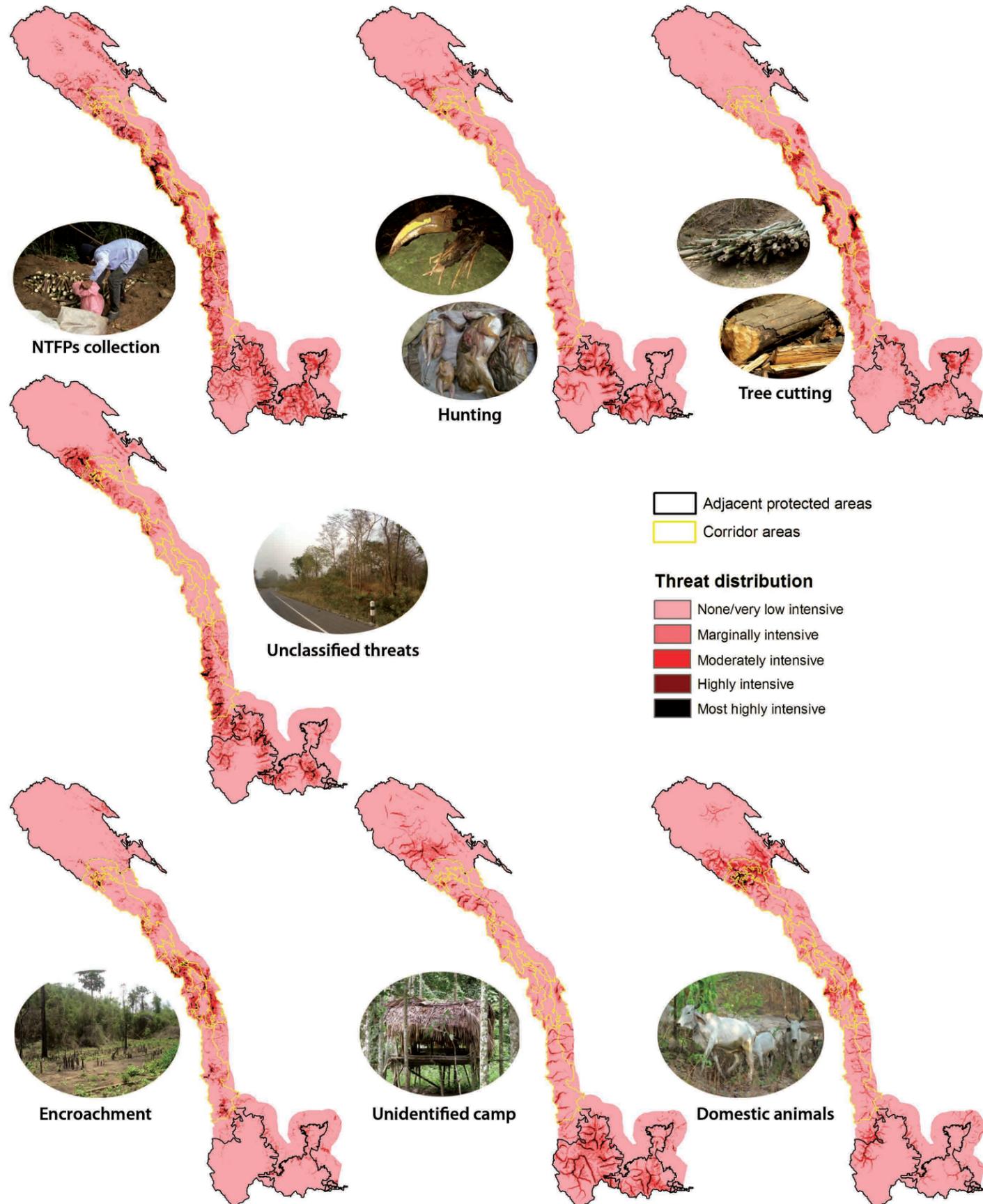
Big cats, elephant, and gaur were distributed mainly in core areas.

Sambar, serow, common muntjac, and great hornbill were distributed in both core and corridor areas in similar proportion.



Distribution maps of 7 landscape species in the Tenasserim corridor and adjacent core areas

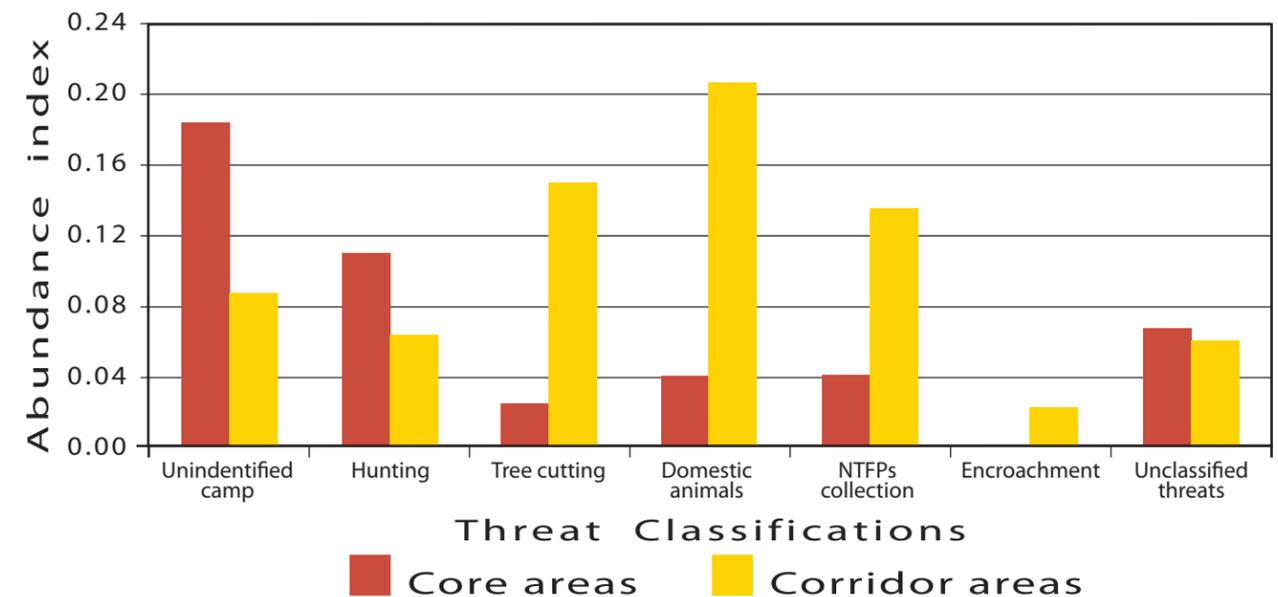
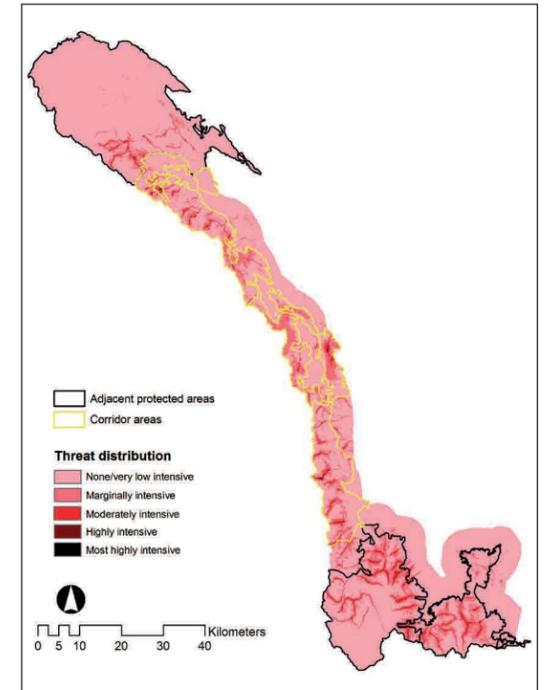
# HUMAN UTILIZATION AND THREATS



## Human utilization of the Tenasserim corridor's biological resources

The study reveals that most important threat to wildlife and biodiversity in Tenasserim corridor is encroachment. The areas susceptible to be encroached are approximately 21.02% of entire landscape. NTFPs collections, disturbance due to livestock, tree cutting and hunting are also alarming threats to wildlife in this landscape.

Threat intensity inside protected areas differs from outside protected areas. Inside protected areas hunting is the most serious threat following with NTFPs collection. In the corridor areas where law enforcement and management are weak, encroachment, NTFPs collection, disturbance due to livestock and tree cutting are negatively affecting to wildlife.



Threat intensity by type of threats in corridor and core areas.

# DESIGNING CORRIDOR FOR LANDSCAPE SPECIES

There are different ways to design conservation corridors for wildlife. For this study, we adopted and adapted a modeling method called Corridor Designer, and ArcGIS tool designed by Beier *et.al.* (2008) from Northern Arizona University, as an aid to think about how to best design corridors or stepping stones in heterogeneous landscape of Tenasserim corridor.

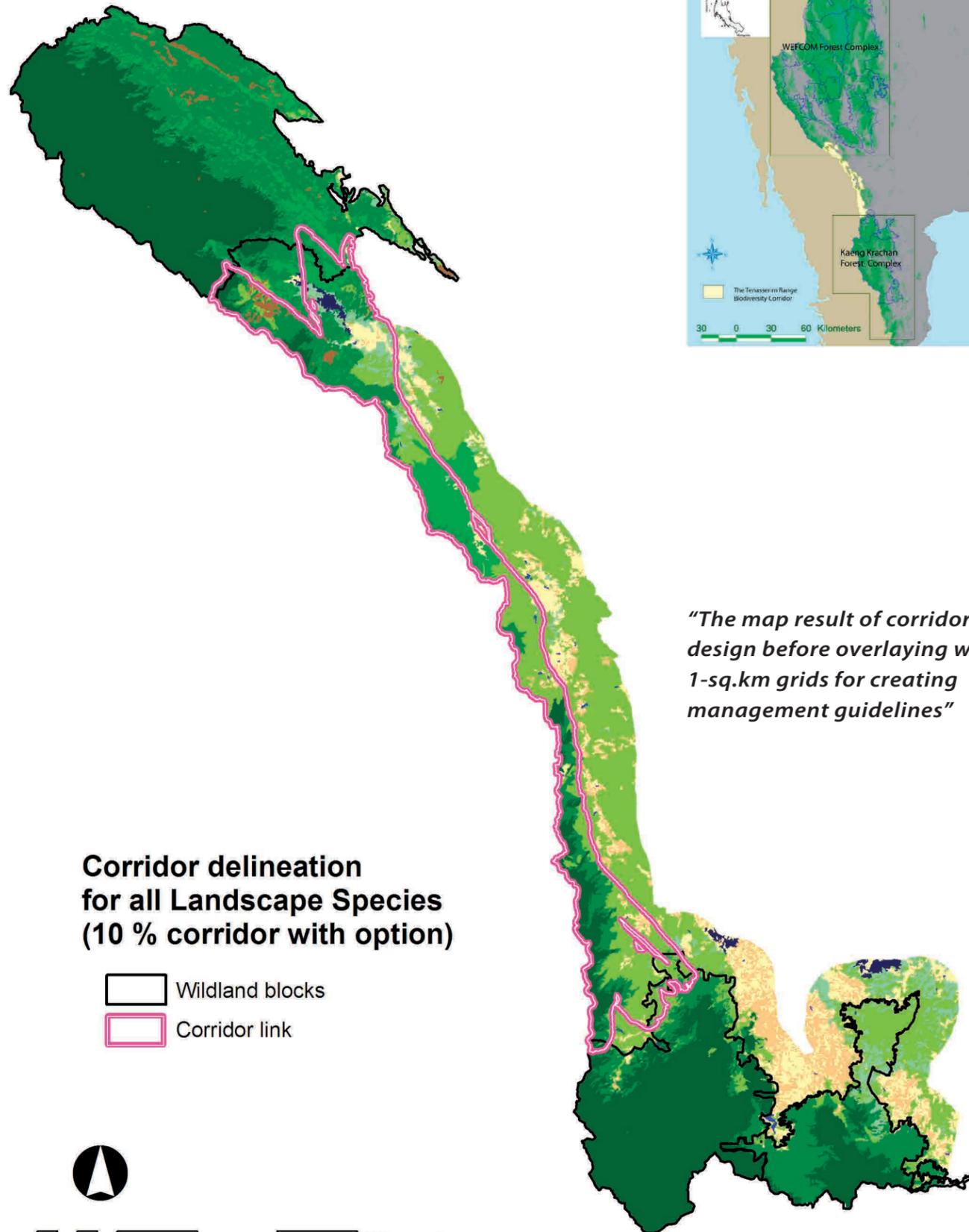
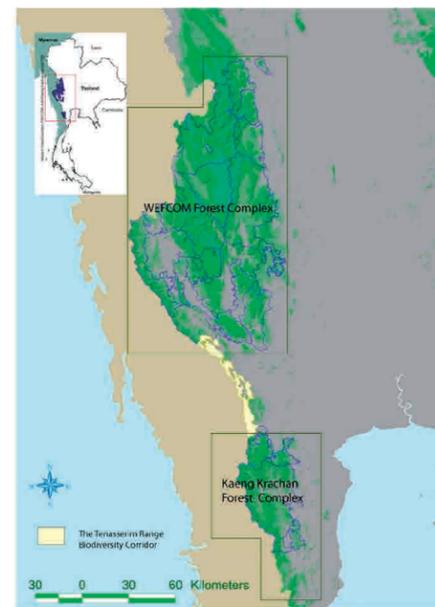
We adopt potential distribution maps as a science-based habitat models for identify critical corridor areas for each landscape species and then unite all of them as a final corridor delineation. The identified corridor lies within the 5 km from the country border. The potential BCI corridor covering approximately 787 km<sup>2</sup> in corridor areas and 432 km<sup>2</sup> in core areas.

## Guidance for managing the Tenasserim corridor for enhancing connectivity for key landscape species (See Map on the right)

We evaluate the quality of habitat along the corridor areas by ranking the percentage of remaining primary forest in square grid cell size of 1 sq km. For guiding management the area was classified into 4 zones

- Zone 1 maintenance zone (primary forest > 50%),
- Zone 2 natural regeneration zone (primary forest more than 1% but less than 50%),
- Zone 3 man-made restoration zone (primary forest less than 1%),
- Zone 4 sustainable use zone (It is the man-made restoration zone with more than 50% of human dominated zone).

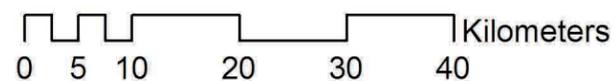
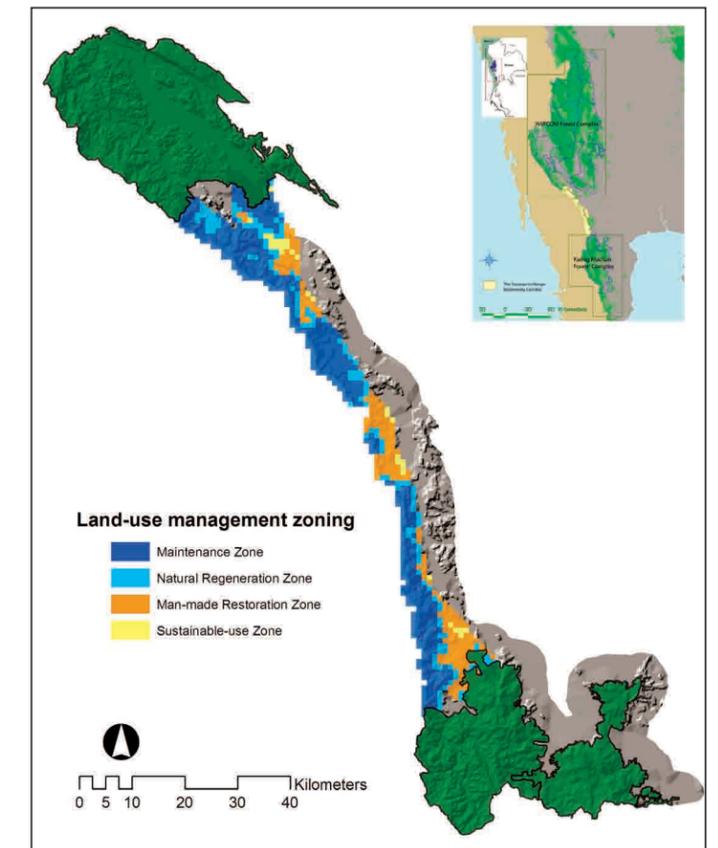
Long-term monitoring programs to monitoring change in land use pattern and movement of landscape species are also important. Stakeholders including national and local government agencies, active non-government organizations, and local people will play an essential role to make it possible.



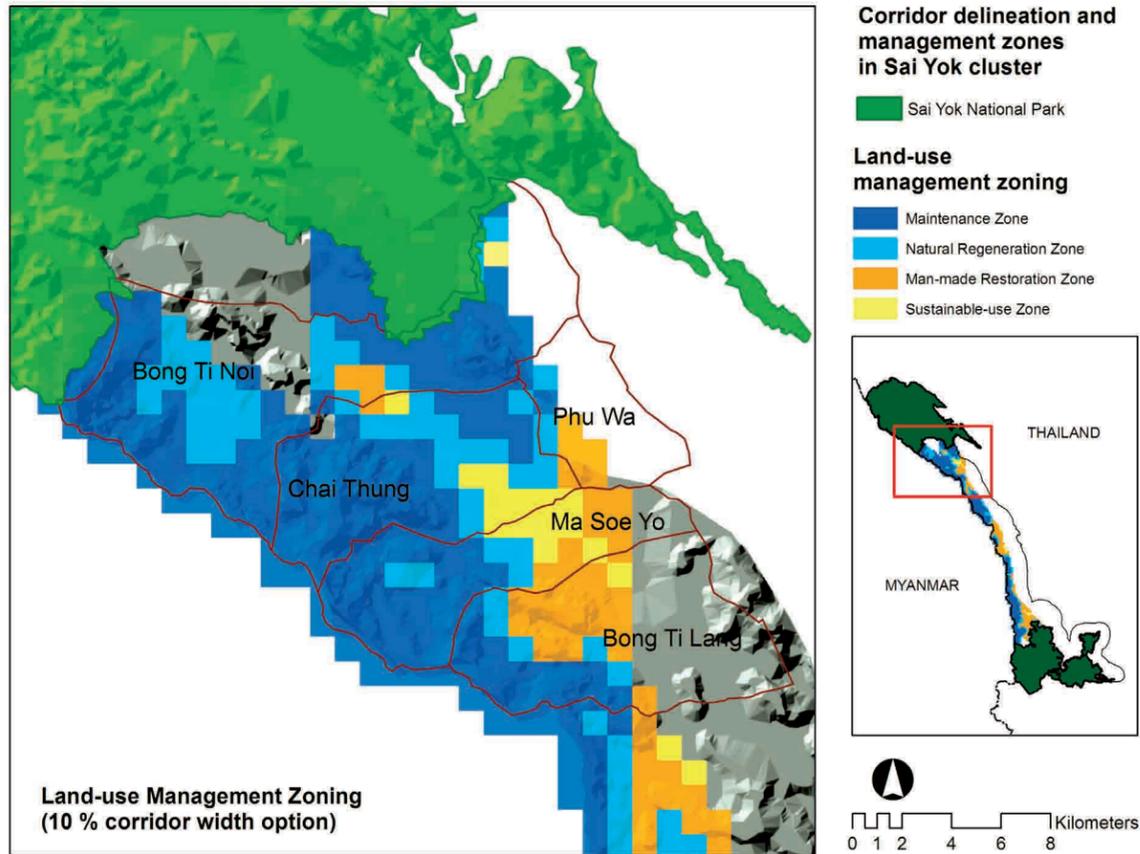
*“The map result of corridor design before overlaying with 1-sq.km grids for creating management guidelines”*

## Corridor delineation for all Landscape Species (10 % corridor with option)

- Wildland blocks
- Corridor link

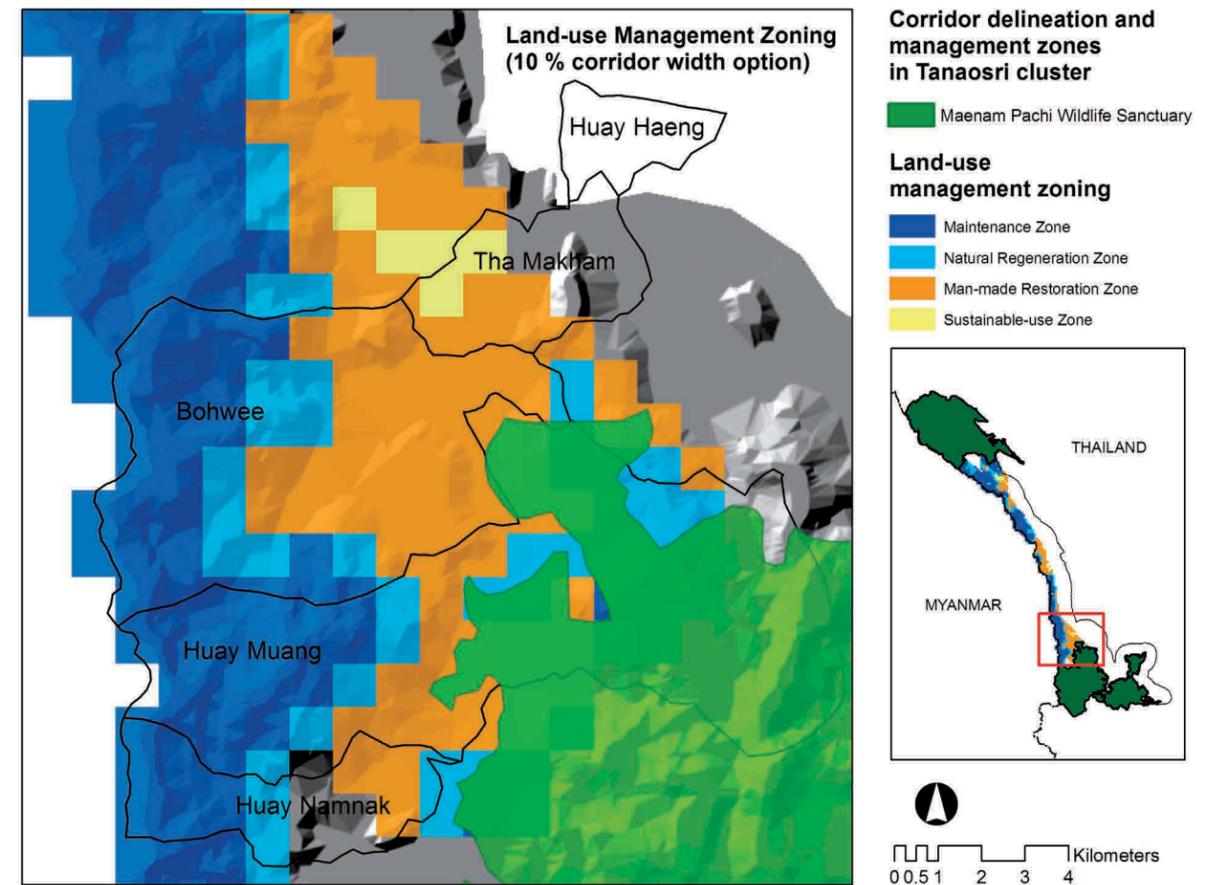


**Guidance for conserving and restoring corridor in SAI YOK CLUSTER**

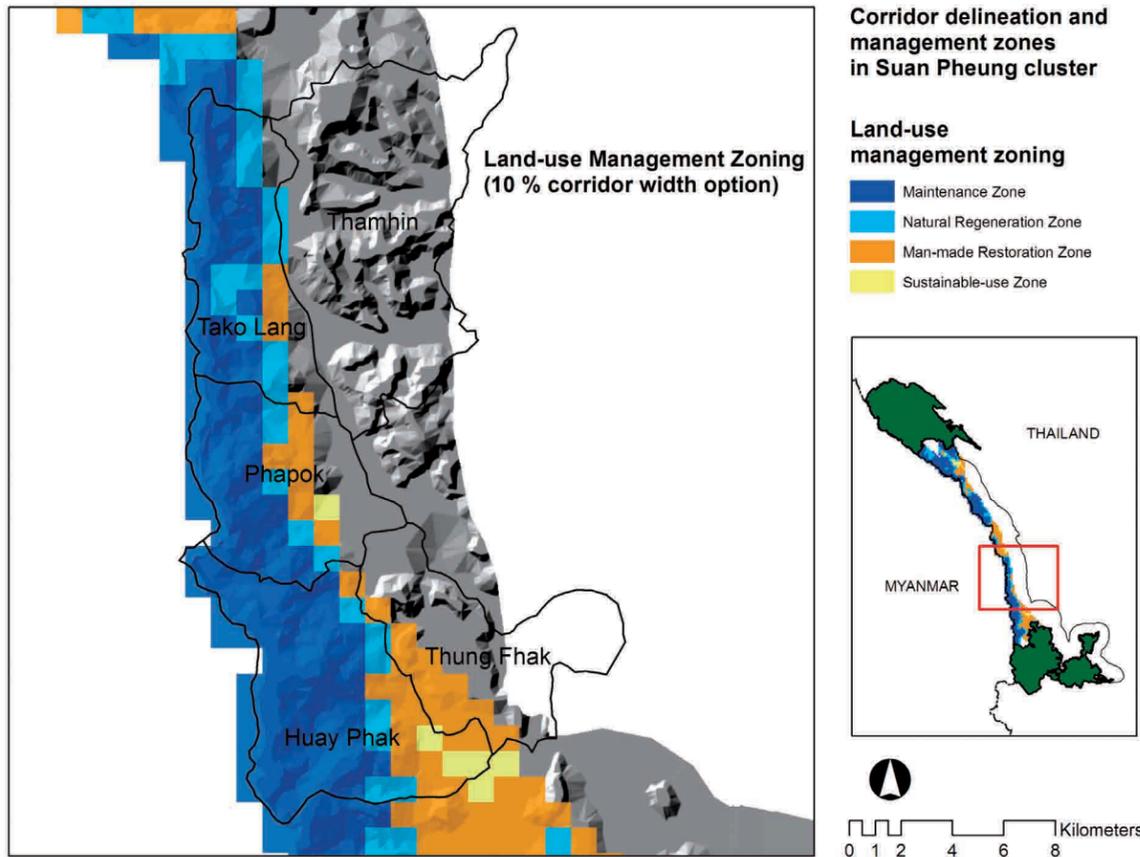


# GUIDANCE FOR RESTORATION OF KEY CLUSTERS

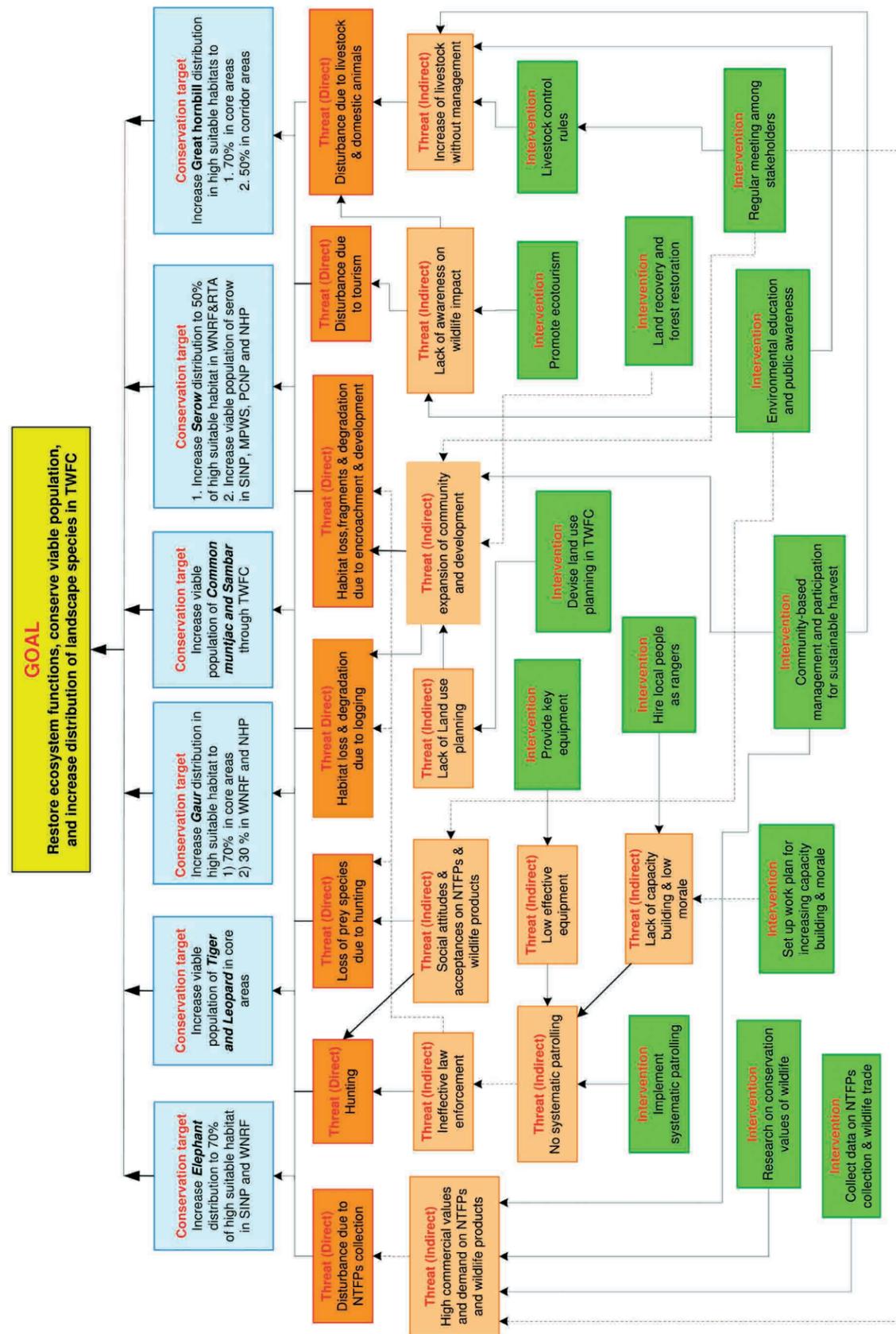
**Guidance for conserving and restoring corridor in TANAOSRI CLUSTER**



**Guidance for conserving and restoring corridor in SUAN PHEUNG CLUSTER**



Conceptual model for the Tenasserim WEFCOM Corridor (TWFC): Linking interventions to impacts



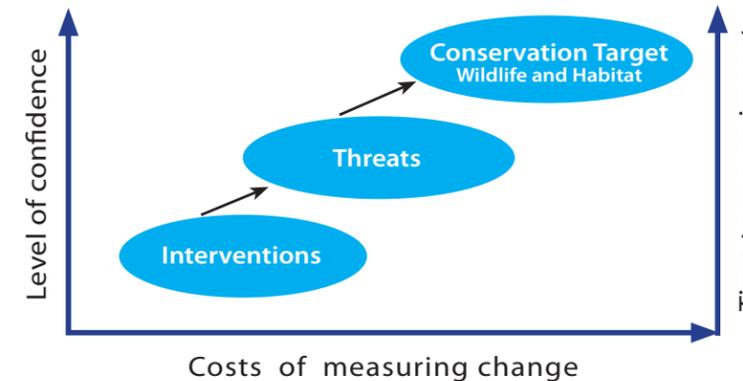
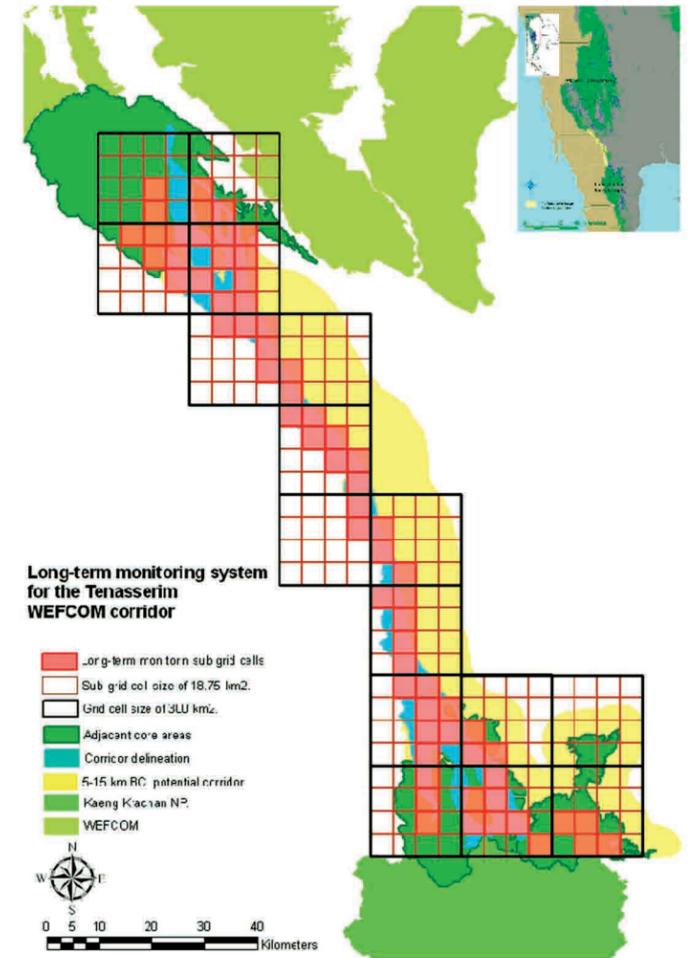
# IMPORTANCE OF LONG-TERM MONITORING

## Long-term wildlife monitoring as indicator of success in BCI

Long-term wildlife monitoring program is important component to measure success of BCI. More systematic monitoring program should be implemented with techniques such as the occupancy survey. It is a suitable method to keep track of key species using the landscape that has low density and detection probability of landscape species. More importantly key local staff and rangers are familiar with the survey techniques already.

The current occupancy survey design has determined 68 sub-grid cells size of 18.75 km<sup>2</sup> in 16 grid cell size of 300 km<sup>2</sup> for long-term monitoring program.

Field data collection should be done every 2-3 years and each time in wet season because the areas in the corridor confronted with scarcity of food and water in dry season and detectability of key landscape species is very rare in dry season.



## Good monitoring program can give better confidence

Linking actions to impacts is the key concept in WCS Living Landscape Program. With all kinds of interventions put into Tenasserim corridor it is important to have a rigorous monitoring system to prove that the interventions help reduce threats and, as a result, increase opportunity for linking landscape species together.

# KEY INTERVENTIONS FOR FUTURE HOPE

## Key interventions for the Tenasserim corridor

INTERVENTION	IMPACT	PRIORITY
<b>CORRIDOR ZONE</b>		
Forest restoration	<ul style="list-style-type: none"> <li>• Widening corridors to facilitate landscape species movement</li> <li>• Limiting the expansion of local communities and other land use and exploitation projects</li> </ul>	High
Landuse and agricultural planning and implementation	<ul style="list-style-type: none"> <li>• Reducing further forest clearing and land exploitation</li> <li>• Use abandoned areas more effectively</li> </ul>	High
NTFPs collection management and regulation	<ul style="list-style-type: none"> <li>• Reducing pressure of unregulated NTFPs collection</li> <li>• Sustainable collection of NTFPs in the area under better system</li> </ul>	High High
EcoCultural tourism promotion	<ul style="list-style-type: none"> <li>• Allowing people to have more appreciation of nature and receive benefits from protecting it.</li> <li>• Limit the growth of mass tourism</li> </ul>	Medium
Promotion of nature education	<ul style="list-style-type: none"> <li>• Building stronger awareness among the public in and around the area</li> </ul>	Medium
<b>CORE ZONE</b>		
Systematic patrol system	<ul style="list-style-type: none"> <li>• Reducing hunting pressure in the areas</li> <li>• Protecting population sources of landscape species.</li> <li>• Allowing dispersal of landscape species into corridor areas.</li> </ul>	High
Other capacity building program for rangers	<ul style="list-style-type: none"> <li>• Build high standard rangers and resource managers</li> </ul>	Medium

### Stakeholders' participation is the key to success

Because most of Tenasserim corridor area is outside protected areas it is necessary to encourage involvement and thorough understanding of the future of the corridor together with addressing economic needs of local and regional people .



Key stakeholders in the Tenasserim corridor are :

- Local people in villages of 4 key clusters
- Local government staff
- Park rangers in the core areas
- Military staff
- Natural historical park staff
- Local educational institutes

WCS Thailand has tried to involve all members of such stakeholders in conducting intensive survey of wildlife in the area, selection of landscape species, and thinking of the future of the corridor.

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Kwanchai Waitanyakarn, WCS-Thailand

Artist: Supawadee Suntornsorn

